IN THE CLAIMS

What is Claimed Is:

1. A method for extracting bio-functional and bio-responsive fractions from biomass, comprising:

providing or obtaining biomass;

treating the biomass in a high-frequency, rotor-stator device to make sheared biomass;

treating the sheared biomass with saturated steam at a time and temperature effective to extract bio-functional fractions;

rapidly depressurizing the biomass and steam;

mixing a depressurized bio-functional fraction with reagent that breaks down the fraction into oligomers and monomers; and

separating the monomers from the each other and the oligomers.

2. The method of claim 1 wherein the biomass is subjected to pressurization at a temperature of about 390 to 460 degrees Fahrenheit.

3. The method of claim 1 wherein the biomass is subjected to pressurization for a time ranging from 2 minutes to 4 hours.

4. The method of claim 1 wherein the separation material used in monomer separation includes styrene crosslinked with divinyl benzene.

5. A process for extraction of monomers from biomass, comprising:

obtaining biomass;

subjecting the biomass to saturated steam at a time and temperature effective to extract the bio-functional materials comprising polymers;

rapidly depressurizing the biomass to extract the bio-functional materials;

mixing the bio-functional materials, in one or more static mixers, with one or more materials to hydrolyze the polymers to form monomeric and oligomeric hydrolysates;

converting the hydrolysates to form a mixture of monomers, having no added acid; and

separating the monomers from the mixture using ion exchange.

6. The process of claim 5 wherein the ion exchange includes media comprising beads that include styrene crosslinked with divinylbenzene.

7. A process for extracting a stereoisomer from biomass, comprising:

providing biomass;

subjecting the biomass to substantially instantaneous pressurization and de-pressurization in a manner effective to separate lignin, hemicellulose and cellulose in the biomass;

hydrolyzing the hemicellulose to form hemicellulose hydrolysates in a mixture free from added acid; and

separating one or more stereoisomers from the hemicellulose hydrolysates using ion exchange.

8. The process of claim 7 and further comprising reducing size of the biomass prior to pressurization.

9. The process of claim 7 and further comprising compacting the biomass prior to pressurization.

10. The process of claim 7 wherein the biomass provided is one or more of wood, beets, corn, soy, wheat, and plant biomass.

11. The process of claim 7 wherein the stereoisomer separated is L-arabinose.

12. The process of claim 7 wherein the biomass is subjected to pressurization at a temperature of about 390 to 460 degrees Fahrenheit.

13. The process of claim 7 wherein the biomass is subjected to pressurization for not more than about 10 minutes.

14. The process of claim 7 wherein the biomass is reduced to a size sawdust.

15. The process of claim 7 and further comprising feeding the biomass for pressurization continuously.

16. The process of claim 7 and further comprising adding moisture to the biomass before pressurization.

17. The process of claim 1 wherein the hydrolysis occurs in a reactor/static mixer.

18. The process of claim 7 wherein sodium hydroxide is added to the static mixer in a flowpath that is counter-current to the flow of hemicellulose.

19. A system for obtaining monosaccharides, oligosaccharides and polysaccharides from biomass, comprising:

a mechanism for substantially instantaneously pressurizing and de-pressurizing biomass to separate the biomass into hemicellulose, cellulose, and lignin;

a heater for heating the hemicellulose to liquefy the hemicellulose;

a static reactor/mixer for mixing a sodium hydroxide with hemicellulose and for making hemicellulose hydrolysates without an addition of acid; and

ion exchange mechanisms comprising ion exchange resin for selectively separating a hemicellulose hydrolysate based upon the component's stereoisomeric identity.

20. The system of claim 1 the ion exchange resin comprises styrene crosslinked with divinyl benzene.

21. The system of claim 19 wherein the hemicellulose product passes through a glass transition state and into its liquefied state very rapidly.

22. The system of claim 15 wherein the hemicellulose hydrolysates comprised arabinose, l-arabinose, d-xylose, l-xylose, d-glucose, l-glucose, and any other racemic carbohydrates.